To this list the writer is now able to add three of the cup-æcidium type of rusts as showing sexual fusions. Further, a large proportion of the fifty species of æcidium cups under investigation have been found to show a multinucleated stage in their development; this stage following, in the three species above mentioned, the sexual fusions. A contribution has been also made in this investigation toward the solution of the problem as to the origin and function of the peridium, it being found to arise in the manner described by Rosen and Richards. Some observations seem to show, moreover, that the peridial cells exert a sort of digestive function, in addition to acting as a protection to the expanding æcidial mass.

Cultures of Uredineæ in 1909: J. C. Arthur, Purdue University.

The paper covers a report in detail of the work in growing plant rusts during the year 1909, this being the eleventh year that the work has been carried on. It is almost entirely devoted to the heteroecious species of grass, sedge and cedar forms. One new species of the last has been separated, having æcia on *Amelanchier* leaves of the type of *Roestelia cornuta* and telia on the branches of red cedar. Only one new combination was worked out among the grass rusts, and none among the sedge rusts, but much additional information is reported on species previously cultivated.

George T. Moore,
Secretary

SOCIETIES AND ACADEMIES

THE PHILOSOPHICAL SOCIETY OF WASHINGTON

The 676th meeting was held on February 12. 1910, President Woodward in the chair. Two papers were read.

The Solar Constant of Radiation: C. G. Abbot, of the Astrophysical Observatory of the Smithsonian Institution.

The speaker stated that when in 1903 determinations of the solar constant of radiation were begun by the Smithsonian Astrophysical Observatory, values ranging from Pouillet's 1.76 to Angström's (withdrawn) value of 4.1 calories were quoted in the best text-books, generally with a preference for Langley's value 3.0 calories. The discrepancy existed (1) because no international standard scale of pyrheliometry had been established, so that measurements of different observers might differ by ten or even twenty per cent., according to what pyrheliometer they employed; (2) because, since no spectrum energy measurements had been made except by Langley (and his wrongly reduced), the observations made were incapable of yielding the correction for loss in air, and hence recourse was had to purely empirical and untrustworthy formulæ of extrapolation.

At Washington, Mt. Wilson and Mt. Whitney (sea-level, one mile and three miles elevation) complete spectro-bolometric and pyrheliometric measurements have been made on several hundred different days from 1903 to 1909. Simultaneous determinations at Washington and Mt. Wilson in 1905 and 1906 agreed within the probable error of the Washington observations. Simultaneous observations at Mt. Wilson and Mt. Whitney in 1909 agreed within 0.5 per cent. Hence it is believed that the formula of Bouger for the atmospheric extinction of monochromatic rays (such as the bolometer observes) is not only theoretically well grounded, but experimentally verified, for otherwise the solar constant values obtained by its aid from such different atmospheric levels could hardly agree.

Three different copies of Abbot's water-flow standard pyrheliometer have been tried on Mt. Wilson with closely agreeing results. In this instrument the measurements are checked by observing known quantities of heat electrically introduced. The scale of the instrument appears to be about three per cent. above that of the new Angström pyrheliometers, but careful redeterminations of the constants of the Abbot pyrheliometers are now being made by Mr. Aldrich, and these may alter the scale by as much as one per cent. When verified, four silver disk secondary pyrheliometers of the Smithsonian Institution will be calibrated to this scale and sent abroad to promote a uniform international system of pyrheliometry.

Provisionally the mean value of the solar constant may be given as 1.92 calories per square centimeter per minute.

Mr. Abbot also spoke briefly of the apparent variations of the solar constant of radiation.

The Nitrogen Thermometer from Zinc to Palladium: A. L. Day and R. B. Sosman, of the Geophysical Laboratory of the Carnegie Institution of Washington. Presented by R. B. Sosman.

The preliminary work of Day and Clement at the geophysical laboratory developed the apparatus for accurate measurement of temperatures with the nitrogen thermometer. It consisted of

the following essential parts: (1) a gas-tight platin-iridium bulb of constant volume; (2) a platinum resistance furnace, arranged to give a uniform temperature over the bulb; (3) a gas-tight furnace jacket, water cooled, arranged to provide the same pressure outside as inside; (4) an open mercury manometer, with the minimum possible unheated volume between bulb and manometer.

In the present work, an alloy of 80 Pt, 20 Rh, has been substituted for the Pt-Ir in order to avoid the error due to contamination of the thermoelements by Ir.

All of the errors and corrections have been examined and their amount, as far as possible, experimentally determined. The greatest error to which the present gas thermometer is subject is the lack of uniformity in temperature in an air bath; the error of next importance is that in the transfer by means of the thermoelement.

The expansion coefficient of the bulb material was determined from 300° to 1400°. Between these limits the expansion is expressed by the formula $10^6\beta = 8.79 + 0.00161\ t$.

The temperatures, on the nitrogen scale, of the melting points of eight metals and two silicates between 400° and 1550° were determined with the ten per cent. Pt-Rh thermoelement as intermediary between the nitrogen thermometer and the fixed points. The metals were all analyzed by Dr. E. T. Allen. Two initial pressures were used, about 220 and 350 mm.; no systematic difference could be observed between the values of t derived from these two pressures. The final results are as follows:

Zinc	in air	in graphite	418.2 ± 0.3
Antimony	in CO	in graphite	629.2 ± 0.5
Silver	in CO	in graphite	960.0 ± 0.7
Gold	in CO	in graphite	1062.4 ± 0.8
Copper	in CO	in graphite	1082.6 ± 0.8
Diopside	in air	in platinum	1391.2 ± 1.5
Nickel	in N	in magnesia	1452.3 ± 2.0
Cobalt	in H	in magnesia	1489.8 ± 2.0
Palladium	in air	in magnesia	1549.2 ± 2.0
Anorthite	in air	in platinum	1549.5 ± 2.0

In addition, the melting temperatures of cadmium (320°) and of aluminum (658°) were obtained, but these metals were not used as standard points.

By adding the optically determined difference of 206° to the palladium point obtained above, the melting point of platinum is found to be 1755°, which is not more than 5° in error.

The curve of the 80 Pt 10 Rh thermoelement was found to deviate considerably from the very generally used parabola passing through zinc, antimony, silver and copper, and extrapolated above the latter temperature. The low value of 1710° for the melting point of platinum obtained by this extrapolation is therefore explained.

There is a disagreement of from 1.0° to 1.3° between the present scale, at its lower end, and the scale hitherto in use for calibrating the platinum resistance thermometer. The cause of the difference is not known. Between 500° and 1100° the present scale is about 1.5° lower than the Reichsanstalt scale in general use. Above 1100°, the temperatures of palladium and platinum obtained by Holborn and Valentiner are shown to be too high, and the new values are about those expected from previous estimates.

R. L. FARIS,
Secretary

THE NEW YORK ACADEMY OF SCIENCES
SECTION OF BIOLOGY

A REGULAR meeting of this section was held at the American Museum of Natural History, December 13, 1909, Chairman Frank M. Chapman presiding. The following papers were read:

Notes of an Ornithologist in South America: Mr. C. WILLIAM BEEBE.

The speaker gave an account of three expeditions to the forest regions of British Guiana, South America, for the purpose of studying and collecting the rarer birds of that locality. Many admirable photographs were shown of rare birds, among them the first photographs ever taken of the hoctyui, the female being shown in her characteristic crouching attitude near the nest and a flock of eleven in one tree. Incidentally some remarkable photographs of mammals were obtained, among them, one showing six capybaras and several young on a river bank taken by Dr. Hiram Bingham, and one of a manatee swimming with mouth and nostrils just above the water.

The Influence of the Nervous System in Regeneration: Mr. A. J. GOLDFARB.

The speaker briefly reviewed the suggestions that had heretofore been made to account for the fact that some animals were able to replace a missing organ, while others were unable to do so. A concise summary was then given of the experimental data that supported the conclusion that regeneration was dependent upon a stimulus exerted by or through the central nervous system.

The speaker then described the experiments that he had made during the last several years, upon

five widely different kinds of animals. In each animal the most painstaking care was taken to make certain that *all* motor or sensory or both of these cells, innervating a given organ had been completely destroyed. In spite of the total removal of the nerve stimuli the missing organ was regenerated in every case. Thus the frog tadpole regenerated its tail, the adult newt *D. viridescens* regenerated its tail and leg, the earthworm its head, the starfish its arm, and the planarian *D. lacteum* the anterior third of its body. It was pointed out that the agreement among these very different organisms probably signified that animals as a whole, whether during their larval or during their adult stage of development, regenerate their missing organs independently of a central nerve stimulus.

At the annual dinner and business meeting of the New York Academy of Sciences, held at the Hotel Endicott, New York City, December 20, 1909, the following officers were elected for the Section of Biology for 1910:

Chairman—Professor Charles B. Davenport.
Secretary—Dr. L. Hussakof.

A REGULAR meeting of this section was held at the American Museum of Natural History, January 10, 1910. In the absence of Chairman Chas. B. Davenport, Mr. Roy W. Miner presided. The following papers were read:

Some Remarks on Myriapods: Mr. ROY W. MINER.

The speaker gave an illustrated talk on the myriapods, dwelling on their classification, evolution and morphology. Handlirsch's theory of the derivation of the Crustacea, Myriapoda and Hexapoda from pro-annelidan stock through trilobite forms was discussed in some detail, special attention being given to the evolution of the ancestral insects (Paleodictyoptera) from the trilobites, and their relation to the primitive myriapod stock. All the more typical myriapods were illustrated and their striking anatomical features commented on.

The Ultra-microscope and its Application to the Study of Microscopically Invisible Particles: Dr. MAX MORSE.

The ultra-microscope was devised by Zsigmondy and Siedentopf on the principle determined by Tyndall, that if a solution is examined under the microscope by means of horizontal illumination and not by light transmitted through it by the substage mirror, the particles within the solution polarize the light and thereby render them visible as scintillations against a dark background. By means of this instrument, solutions which appear perfectly homogeneous by means of the ordinary microscope are shown to be composed of particles in suspension. Bodies approaching the dimensions of molecules can be made visible.

Colloidal solutions have been analyzed by means of the ultra-microscope and shown to be suspensions of particles in a homogeneous medium. Thus, colloidal gold and platinum are resolved into such *pseudo*-solutions. Albumens fall under this heading and studies of their nature have shown that they are not homogeneous in solution, but are rather fine suspensions.

The ultra-microscope as first devised has been modified so as to be adapted to the study of living bacteria. The substage condenser of a microscope is replaced by one where the lens, in place of being biconvex, is parabolic and a stop is placed in the center of the disc so that no *direct* rays pass to the eye, but only those that have been polarized by the bacteria which receive the rays that are sent through them horizontally. The bacteria flora of teeth was shown. Spirochætes and rod forms are seen and their locomotor organs are made visible.

Notes on the Restorations of the Cretaceous Birds Hesperornis and Baptornis: Mr. BARNUM BROWN.

A few brief notes from a forthcoming paper were presented. The anatomy of *Hesperornis* as known from described material was discussed and compared with a skeleton recently mounted in the American Museum. In this specimen for the first time a complete tail is known. The swimming pose here chosen is accepted as the one that best represents the aquatic habits of the bird and more nearly conforms to the structure of the limbs. The peculiar arrangements of the palate bones in *Hesperornis* and the contemporary *Baptornis* were shown to constitute characters that distinguish them from all known birds.

Two new specimens have made possible a paper restoration of *Baptornis* which in some characters is more primitive than *Hesperornis*. The striking features are a complete fibula, heretofore known only in *Archæopteryx* and a very long tail of which fourteen vertebræ are preserved. There were at least sixteen. The palate bones are like those of *Hesperornis*.

L. HUSSAKOF,
Secretary

AMERICAN MUSEUM OF
NATURAL HISTORY